UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/049,291	05/31/2002	Snorre Harald Christiansen	219307US2PCT	9475

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EXAMINER
PROCTOR, JASON SCOTT

ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 08/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	10/049,291	CHRISTIANSEN ET AL.
	Examiner	Art Unit
	Jason Proctor	2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>08 May 2004</u>.

2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1-9</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) <u>1-9</u> is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on <u>31 May 2002</u> is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☒ All   b) ☐ Some *   c) ☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date <u>2/11/2002</u>.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Claims 1-9 have been submitted for examination. Claims 3-4 and 6-9 have been amended by preliminary amendment received on 31 May 2002. Claims 1-9 are pending in the application.

Claims 1-9 have been rejected.

Specification

1.   The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use. In particular, the specification lacks the necessary section headings. The Examiner will not object to omitting section headings rather than supplying the phrase "Not Applicable" where appropriate.

Arrangement of the Specification

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. <u>Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading.</u> If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

(a) TITLE OF THE INVENTION.
(b) CROSS-REFERENCE TO RELATED APPLICATIONS.
(c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR
      DEVELOPMENT.
(d) THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT
(e) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A
      COMPACT DISC (See 37 CFR 1.52(e)(5) and MPEP 608.05. Computer program
      listings (37 CFR 1.96(c)), "Sequence Listings" (37 CFR 1.821(c)), and tables
      having more than 50 pages of text are permitted to be submitted on compact
      discs.) or
      REFERENCE TO A "MICROFICHE APPENDIX" (See MPEP § 608.05(a).
      "Microfiche Appendices" were accepted by the Office until March 1, 2001.)
(f) BACKGROUND OF THE INVENTION.
      (1) Field of the Invention.
      (2) Description of Related Art including information disclosed under 37 CFR 1.97
      and 1.98.

(g) BRIEF SUMMARY OF THE INVENTION.
(h) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
(i) DETAILED DESCRIPTION OF THE INVENTION.
(j) CLAIM OR CLAIMS (commencing on a separate sheet).
(k) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
(l) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

2.   It appears in several instances that Applicants are attempting to incorporate material by reference. [*D. Colton and R. Kress*, page 5; *S.S.M. Rao, D.R. Wilton, and A.W. Glisson*, page 8; *A. Bendali*, page 10; *R. Barrett, M. Berry, T.F. Chan, J. Demmel, J. Donate, J. Dongarra, V. Elijkhout, R. Pozi, C. Romine, and H. Van der Vorst*, page 10; *C.T. Kelley*, page 10; *M. Cessenat*, page 13; *P.G. Ciarlet, Ed. J.L. Lions*, page 15; *J.E. Roberts, J.M. Thomas, Ed. J.L. Lions*, page 18; *W.C. Chew, J.M. Jin, C.C. Lu, E. Michielssen, J.M. Song*, page 22; *J.M. Song, C.C. Lu, W.C. Chew, S.W. Lee*, page 22; *E. Bleszynski, M. Bleszynski, T. Jaroszewicz*, page 22]. The attempt to incorporate this subject matter by reference should be made with the statement "which is hereby incorporated by reference" rather than "insofar as this document forms an integral part of the description". This language is required to unambiguously distinguish subject matter related to the invention from Applicants' admitted prior art.

3.   The disclosure is objected to because of the following informalities: The typesetting used in the numerous equations does not have satisfactory reproduction characteristics and is otherwise illegible. While it may be possible to infer certain small symbols, this guesswork is unacceptable for examination purposes.

For example, it is impossible to determine if the small subscripts in Eq. (12) are i, j, 1, some other symbol, or if some of the subscripts differ from the others. These extremely small fonts are used throughout the equations in the specification.

Appropriate correction is required.

4.   The disclosure is objected to because of the following informalities: Page 3, lines 3-5 appear to contain a typographical error where "IT" in line 3 becomes "It" in line 5. The Examiner respectfully requests Applicants' assistance in carefully reviewing the numerous complicated equations in this application for accuracy and typographical or typesetting errors.

Appropriate correction is required.

Abstract

5.   Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

The abstract of this application comprises four paragraphs and is substantially longer than 150 words. The Examiner respectfully suggests combining paragraphs 2-4 and editing the language to be more succinct.

Drawings

6.   The drawings submitted on 31 May 2002 are acceptable for examination purposes. Please see attached from PTO-948 regarding the formal requirements that must be met before the application is allowable.

Claim Objections

7.   Claims 1, 4 and 5 are objected to because of the following informalities: The typesetting used in the equations and symbols is illegible. Independent claim 1 contains numerous artifacts in the vicinity of the script characters. Dependent claim 5 contains numerous symbols and subscripts that are impossible to adequately identify. Appropriate correction is required.

Claim Rejections - 35 USC § 101

35 U.S.C. § 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

8.   Claims 1-9 are rejected under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter. Claims 1-9 are directed toward a mathematical algorithm and are therefore nonstatutory.

MPEP 2106 suggests that computer related methods be claimed as tangibly embodied on a computer readable medium, however the instant application provides no such disclosure. The specification fails to describe any tangible implementation of the invention. Rather than defining a statutory process, the claims therefore describe a nonstatutory mathematical algorithm. MPEP 2106(II) provides for the Examiner indicating how rejections under 35 U.S.C. § 101 may be

overcome, however in light of the lack of tangible embodiment in the disclosure, the Examiner is

unable to make such a suggestion.

To expedite a complete examination of the instant application the claims rejected under

35 U.S.C. § 101 (nonstatutory) above are further rejected as set forth below in anticipation of

applicant amending these claims to place them within the four statutory categories of invention.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making
> and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it
> pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode
> contemplated by the inventor of carrying out his invention.

9.   Claims 1-9 are rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with

the written description requirement.   The claim(s) contains subject matter which was not

described in the specification in such a way as to reasonably convey to one skilled in the relevant

art that the inventor(s), at the time the application was filed, had possession of the claimed

invention. The disclosure presents an abstract outline of how a person could combine numerous

techniques known in the art to presumably arrive at the claimed algorithm. The disclosure omits

any exemplary computations or exemplary embodiments of the invention. Although asserted to

be true, the description fails to show the algorithm as functionally correct or useful.

Particularly regarding claims 6 and 7, the disclosure teaches that the Fast Multilevel

Multipole Method (FMM) and the Adaptive Integral Methods (AIM) may be used. The

disclosure does not describe the invention as actually using these methods and therefore fails to

adequately describe the invention of claims 6 and 7.

Particularly regarding claims 8 and 9, the disclosure fails to provide a description of these limitations to a reasonable level of detail. The disclosure merely suggests that the invention may be combined with an antenna design tool or used to calculate a radar cross section (page 1, lines 4-16) but fails to provide any details of these implementations. Other references are made to these uses for the invention but nowhere is there adequate written description for these claims.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10.   Claims 1-9 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the language "so-called", as in "the so-called interaction matrix" and "the so-called boundary integral equation of electromagnetism" which renders the claim vague and indefinite. It is unclear if this language attempts to define a phrase in the body of the claim or to identify portions of the invention which are prior art.

Claim 1 recites the phrase "the iterative algorithm making it possible to solve an equation" which renders the claim vague and indefinite. It is unclear what specific limitation is defined by this language. It is unclear to what is referred by "an equation", especially if this refers to a previous limitation or an arbitrary equation.

Claim 1 recites an algorithm step of "a determination of a matrix M [...]" which renders the claim vague and indefinite. It is unclear what "a determination" includes or restricts from the prior art, or perhaps intended limitation is "computation of a determinant of a matrix M [...]".

Claim 1 recites steps (a), (b), (b), (c) which renders the method vague and indefinite. The Examiner presumes the recited steps are identified in the order they are presented as (a), (b), (c), (d).

11.   Claim 5 recites numerous equations that are illegible. While the typesetting has been objected to *supra*, it is further impossible to determine the metes and bounds of a claim because the limitations cannot be adequately identified.

12.   Claim 6 recites the limitation "the iterative algorithm used is a fast algorithm, of the multilevel multipole method type." The term "fast" is a relative term that is not defined in the claim or the specification. The Examiner respectfully suggests language similar to the specification, page 22, which states "Fast Multilevel Multiple Methods" and "(FMM)", both of which refers to a specific family of methods and not to the term "fast" as a generic adjective.

13.   Claim 7 similarly recites the limitation "the iterative algorithm used is a fast algorithm, of the adaptive integral method type" which is rejected for the same reasons as claim 6. The Examiner suggests language similar to the specification, page 22, which states "Adaptive Integral Methods (AIM)".

14.   Claim 8 provides for the use of the algorithm in an antenna design tool, but, since the claim does not set forth any steps involved in the method/process, it is unclear what

method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced.

Claim8 is rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App. 1967) and *Clinical Products, Ltd.* v. *Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966).

The Examiner respectfully suggests a dependent claim wherein the body is an antenna to resolve the issues under 35 U.S.C. § 112, second paragraph. The Examiner is unable to make a suggestion that overcomes the rejection under 35 U.S.C. § 101.

15. Claim 9 recites a limitation "the body is an object of known shape for which one seeks to determine the radar cross section (RCS)" which renders the claim vague and indefinite. It is unclear how to interpret a limitation that defines an algorithm according to a person's goal. The Examiner respectfully suggests claiming that the body is a known shape and that the algorithm calculates the radar cross section.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17.   The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459

(1966), that are applied for establishing a background for determining obviousness under 35

U.S.C. 103(a) are summarized as follows:

1.   Determining the scope and contents of the prior art.
2.   Ascertaining the differences between the prior art and the claims at issue.
3.   Resolving the level of ordinary skill in the pertinent art.
4.   Considering objective evidence present in the application indicating obviousness
       or nonobviousness.

18.   Claims 1-4 and 6-9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over US

Patent No. 6,691,076 to Nagase et al. (Nagase) in view of US Patent No. 5,966,524 to Burnett et

al. (Burnett), further in view of Applicants' admissions.

Regarding claim 1, Nagase teaches an electromagnetic field intensity calculating method

for calculating the intensity of the electromagnetic field emitted from a device under

consideration.   The method comprises the steps of obtaining a plurality of shell elements

including at least one triangular shell element by virtually dividing the device under

consideration into a mesh. (column 2, lines 18-43).

Burnett teaches an "electromagnetic infinite element" for calculating electromagnetic

radiation in open regions surrounding the emitting object (column 4, lines 5-18). The method

makes use of finite element techniques (FEM) to calculate the results without introducing

numerical artifacts that would otherwise contaminate the solution at the boundary surface

(column 4, lines 19-43).

Therefore it would have been obvious to a person of ordinary skill in the art to combine

the teachings of Nagase and Burnett to arrive at a method of simulating the electromagnetic field

emitted from a device under design [*consideration*] in open regions using a finite element method.   FEM techniques are known in the art as attested to by Applicants' admission (specification, page 1, lines 36-38; page 15, lines 30-35).   Applicants' further admit that it is known to compute the radiation pattern at infinity directly from the electric and magnetic currents on the surface of the antenna (specification, page 2, lines 9-11).

The further limitations of claim 1 relate directly to the mathematical algorithm used to solve the concept suggested by Nagase in view of Burnett.   These steps are admitted by Applicant as prior art.

A determination of a matrix M ("A*pproximation par éléments finis de surface de problèmes de divergence des ondes électromagnétics* [Finite surface element approximation of electromagnetic wave diffraction problems]" by A. Bendali – Thesis of the University of Paris VI, 1984) (specification, page 10, lines 1-9).

A determination of a preconditioner Z of the matrix M (*"Templates for the Solution of Linear Systems : Building Blocks for Iterative Methods"* by R. Barrett, M. Berry, T.F. Chan, J. Demmel, J. Donate, J. Dongarra, V. Elijkhout, R. Pozi, C. Romine, and H. Van der Vorst – SIAM (1994)) (specification, page 10, lines 11-30) and (Mathematical Methods in Electromagnetism, Linear Theory and Applications" by M. Cessenat – World Scientific Publishing Co. page 89, 1996) (specification, page 13, lines 1-9).

A determination of the currents which flow around the surface of the body (*"Integral Equation Methods in Scattering Theory"* by D. Colton and R. Kress – John Wiley & Sons, New York, 1983) (specification, page 5, lines 16-26).

A determination of the wave scattered by said body from said surface currents (*The electromagnetic field radiated at any point in space can be computed from the field of current flowing around the surface of said antenna, also referred to as electric magnetic surface currents.* [...] *This computation, well known in electromagnetism, is recalled in the document* ["Integral Equation Methods in Scattering Theory", cited *supra*]) (specification, page 5, lines 16-26).

Similarly the limitations of claims 2-3 and 6-7 are described in the specification as prior art.

Regarding Raviart-Thomas space, see specification, page 8, line 26 – page 9, line 2.

Regarding implicit determination of the preconditioner Z and Z = `JMJ, see specification, page 22, lines 9-34.

Regarding fast multilevel multipole methods and adaptive integral methods, see specification, page 22, lines 9-34.

Regarding claim 8, Nagase teaches using the method to calculate the performance of an antenna (column 1, lines 10-15). Nagase further teaches the device is under consideration (column 2, lines 24-31) which would be interpreted by a person of ordinary skill in the art as implying that the method is used to find the optimal design for the antenna.

Further regarding claim 8, Burnett discloses using the method for antenna design (column 5, lines 39-41).

Regarding claim 9, Burnett discloses using the method to determine the radar cross

section [*radar signature*] of objects (column 5, lines 43-50).

Potentially Allowable Subject Matter

19.   Claim 5 may be allowable if rewritten or amended to overcome the rejection(s) under 35

U.S.C. §§ 112 and 101 set forth in this Office action.

The closes prior art made of record fails to disclose or suggest the Examiner's best

interpretation of the particular equations presented in claim 5. While various numerical methods

are suggested in the prior art, in light of the complexity of this field of technology, a person of

ordinary skill would need a certain impetus to arrive at the equations defined by claim 5. As the

prior art made of record fails to disclose or suggest those particular equations, they appear to be

novel and non-obvious over the prior art. However, the allowability of claim 5 is clearly

predicated upon the manner in which Applicants' resolve the numerous issues under 35 U.S.C.

§§ 112 and 101.

Conclusion

Art considered pertinent by the examiner but not applied has been cited on form PTO-

892.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Proctor whose telephone number is (571) 272-3713. The examiner can normally be reached on 8:30 am-4:30 pm M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Picard can be reached at (571) 272-3749. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: 571-272-2100. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jason Proctor
Examiner
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